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Najib Abi Chebel, Florence Gaunet, Pascale Chavet, Christine Assaiante, Christophe Bourdin, F R Sarlegna

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Does visual experience influence arm proprioception and its lateralization? Evidence from passive matching performance in congenitally-blind and sighted adults.

N. Abi Chebel, F. Gaunet, P. Chavet, C. Assaiante, C. Bourdin, Fabrice Sarlegna

Marseille, France

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Introduction

Proprioception is key to perception and action, but how can it be improved?

Here we tested the hypothesis that vision calibrates proprioception. If so, one could predict that lack of vision impairs proprioception.

However, there is evidence of compensatory, cross-modal plasticity in blind individuals:

supranormal auditory perception, supranormal tactile perception ... One could thus predict that lack of vision improves proprioception.

Proprioception is not homogenous across the body:

for instance, proprioception of the non-dominant arm is often more accurate/precise than proprioception of the dominant arm.

Considering that lateralization differs between blind and sighted, we predicted that visual experience would influence the lateralization of arm proprioception.

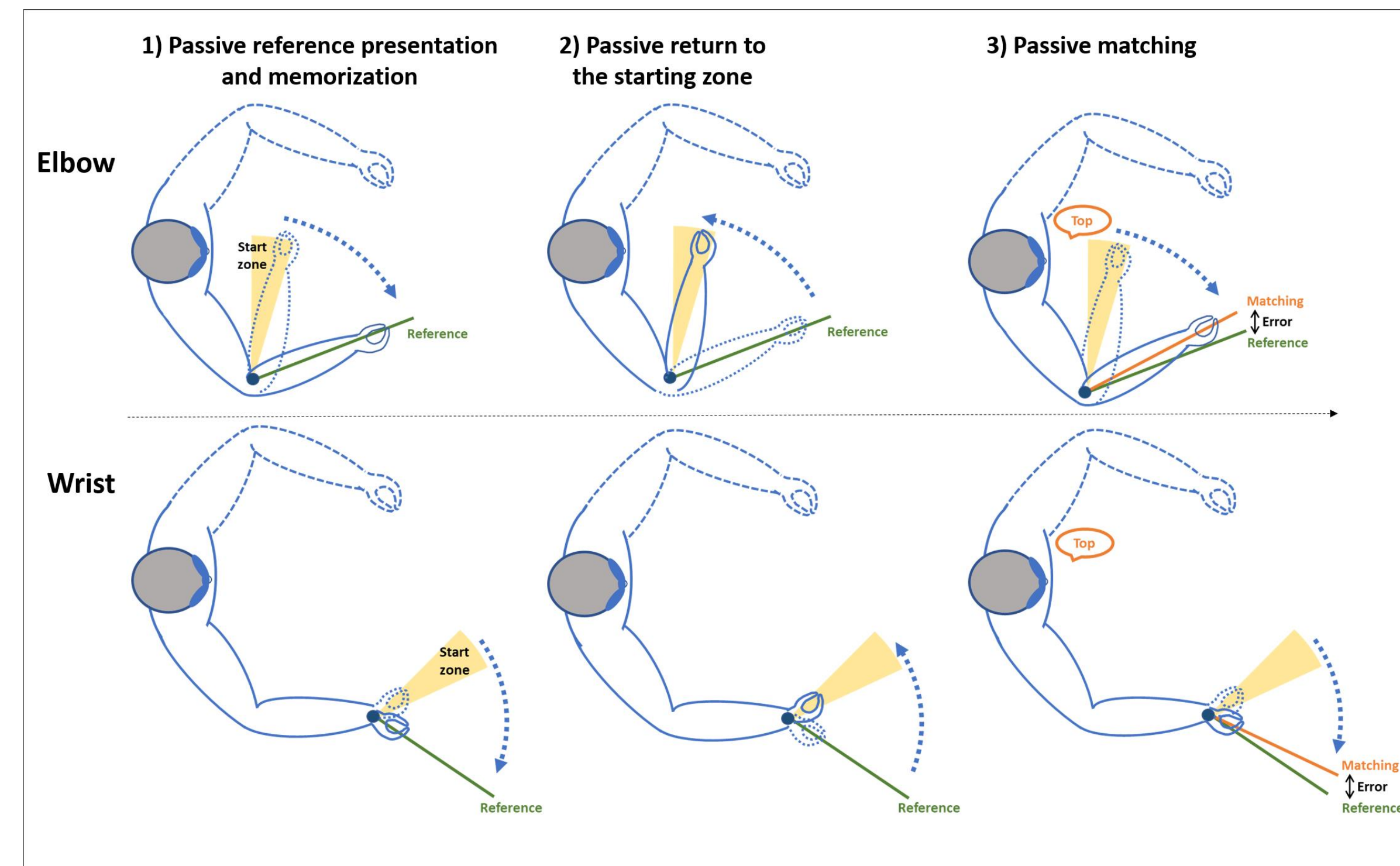
Methods: two groups of right-hand adults

➤ Sighted individuals (n=8; 3 females); Age 43 ± 17 years

➤ Congenitally blind (n=8; 3 females); Age 43 ± 13 years

Blind subject	Etiology	Independence in orientation & mobility	Age	Sex	Occupation
1	Congenital glaucoma	Low	21	Male	Student
2	Congenital eye malformation	Very low	26	Male	Job seeker
3	Congenital glaucoma	High	44	Male	Association volunteer
4	Congenital glaucoma	Moderate	45	Male	Technology instructor for blind
5	Leber congenital amaurosis	High	49	Female	Engineer
6	Congenital glaucoma	High	50	Female	Association volunteer
7	Congenital glaucoma	Moderate	53	Female	Association volunteer
8	Congenital glaucoma	High	61	Male	Piano tuner and repairer

Methods: Passive, ipsilateral matching task



Blindfolded participants
Slow motion (speed < 5 deg/s)

Non-dominant or dominant arm
Elbow or wrist joint

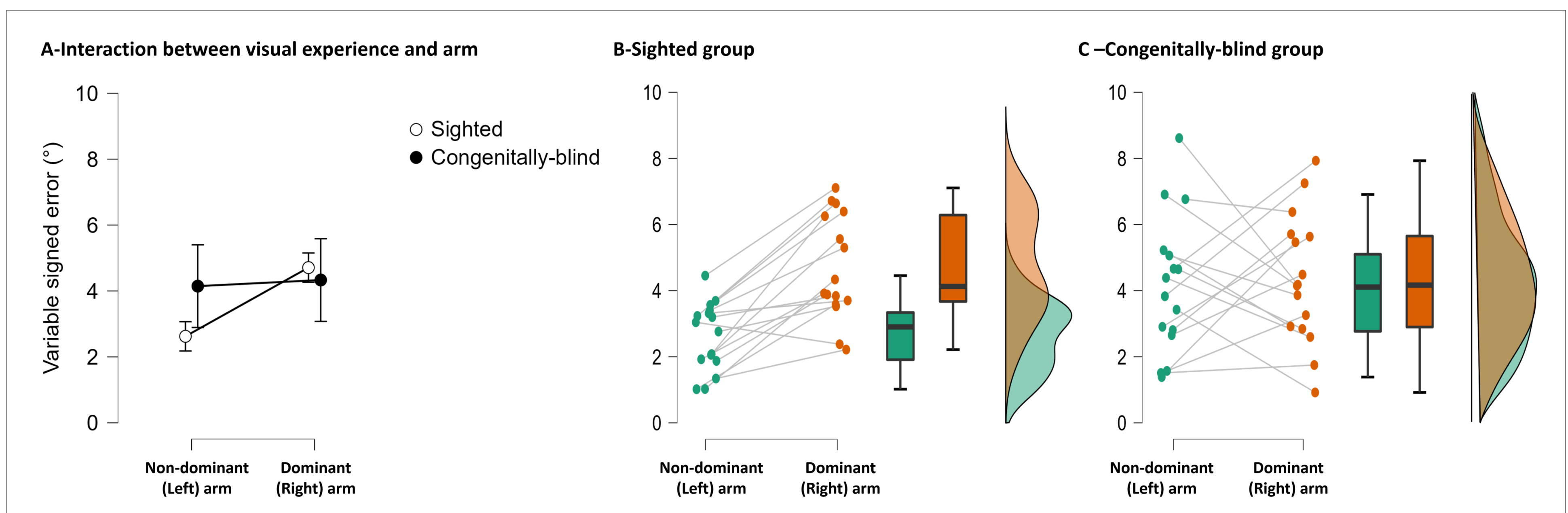
6 trials/condition, in random order

Data analysis

Mean signed error, mean absolute error
Variable (SD) signed error, absolute error

2 Groups x 2 Arms x 2 Joints

Results on proprioceptive perception



Take-home

- Proprioceptive perception is more precise for the non-dominant arm of healthy individuals, a robust finding likely related to limb/hemispheric specialization.
- Proprioceptive lateralization is influenced by lack of early visual experience.
- Visual feedback specifically improves non-dominant arm proprioception in healthy individuals.